SUPPLEMENT.

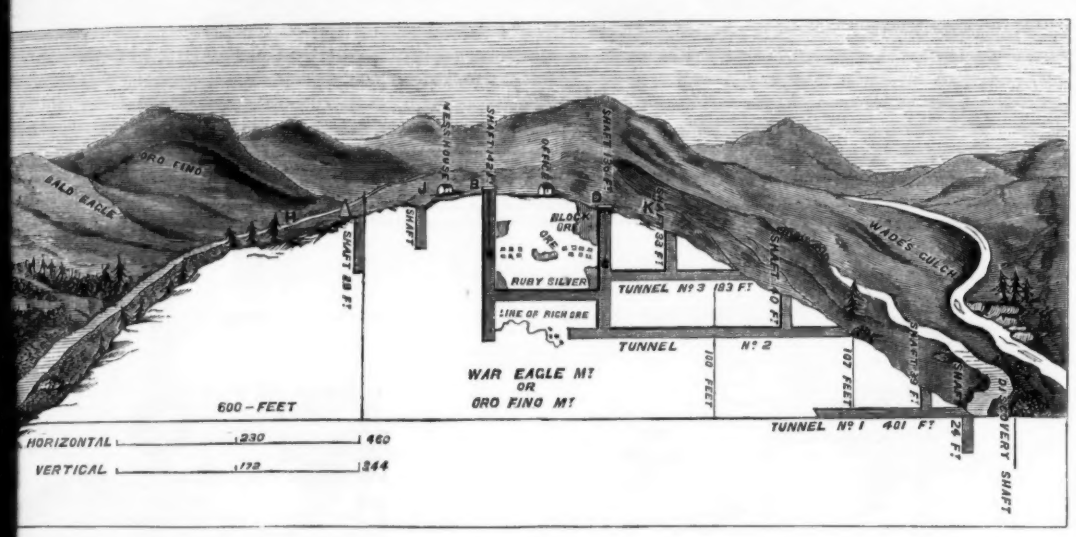
The Mining Journal,

AILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

1661.—Vol. XXXVII. LONDON, SATURDAY, JUNE 22, 1867. {STAMPED .. SIXPENCE. {UNSTAMPED. FIVEPENCE.

SILVER MINING IN THE UNITED STATES.



ERAL WEALTH OF THE UNITED STATES in Colorado, Nedaho will soon be as accessible as the mines of Michigan antic States. The announcement in the *New York Tribune* that the Union Pacific Railroad, under President Dix (the Minister at Paris), Vice-President Durant, and Treasurer e completed to the foot of the Rocky Mountains, and fully th locomotives, rolling stock, repair shops, depôts, stations, &. 1, connects Colorado with the Atlantic coast; meantral Pacific Railroad, which has already been completed s east from Sacramento, and is now being rapidly built ith the Union Pacific Railroad, creates for the silver vada and Idaho a railway communication with San Fran construction of the Pacific Railroad will add more than industrial and mining population of the country, whilst migration from the East is now rapidly filling the plea with hardy and thriving agriculturists.

lifornia, so in Colorado, in Nevada, and Idaho, successful mainly dependent upon the cost of labour, supplies, and on; and these are now to be obtained at prices that will nce the value of the mines.

mountains of Idaho territory are supposed to contain mines of silver that have yet been discovered upon the ontinent. In our issue of June 8 we alluded to the speciy silver, &c., that, in the Paris Exposition, represent the Poorman, Oro Fino, and Morning Star, upon Oro Fino arson district, Owyhee County, Idaho. The extraordiobtained from the Poorman in less than six months' excited such general interest, that we have been induced from an American Journal the sectional map of the w its location upon the eastern crest of Oro Fino Mounexhibit the small space from which silver ore was mined d, by the old mill crushing and amalgam process, over bullion. Of this ore upwards of 15 tons were selected to New York, *via* San Francisco, that produced an ave- cent. in bullion. From this shipment were taken the hibited at Paris, one of which weighed, when mined, g the largest piece of ruby silver on record.

D. Walbridge, the superintendent of the Poorman Mine, control the equally valuable and productive Oro Fino Star Mines, which are also situated upon the Oro Fino res from these mines have been assayed by Messrs. John- and Co., and Mr. F. Claudet, of London; and numerricks, the product of the Morning Star Mill, exhibited Bank.

dge has forwarded to London photographs of Oro Fino water-power, crushing mills, mining houses, &c.; sec- of the mines, the monthly record of the product of the production, of supplies, transportation, &c. These can office of Mr. W. H. Grenelle, 52, Cannon-street, E.C., have been requested to refer all such as are desirous to sted in American mines.

N OF LOSS IN GOLD MINING.—With a view to prevent common in extracting gold from quartz, Mr. E. R. Chapin, of igned a very ingenious contrivance, which he terms a concen- rator. The model, which he has determined to send to Wash- of getting out a patent for his invention, could easily be placed t pocket. It is entirely different every way from any separator that we have ever seen used by quartz miners. A shallow pan, tor, elevated an inch above the concentrator, first receives the , quicksilver and gold escaping from the mill above. The parator being deeper than the sides or mouth where the water uicksilver and gold naturally settle down, while the light sand ew over with the water into the concentrator, which looks somellow top of a soup-tureen. Small holes are perforated in the ncentrator, through which the sulphurets pass into small pans erything else flows over the top into conductors, which convey ole machine is suspended on four stout wires, each fastened at the bottom in a strong framework. Diminutive cog-wheels attached to a cylinder, which are kept in motion by the mill above, set the machine in motion, and give both the separator and the concentrator an easy rocking motion.

THE MINERAL RESOURCES OF COSTA RICA—No. II.

But in considering whether a country offers a desirable field for the employment of British capital, many circumstances besides the actual existence of mineral deposits must be taken into consideration; it must be shown that there is no fear of serious internal dissension; that the general industry of the country is such as to give a sufficient guarantee that the miners will not be placed at a disadvantage through having to bear additional burdens, in consequence of the poverty of the other portion of the community; and, above all, that the inhabitants show a desire to co-operate with the British capitalists, and not simply to meet them with the sole object of extracting as much ready money as possible, regardless of whether the unfortunate buyers can ever turn their bargain to commercial advantage. In all these respects Costa Rica offers all that could be desired; it is the most flourishing, healthy, and happy republic in Central America, and, it might be added, upon the entire American continent; its general resources are such as to ensure its continued prosperity; and those interested in the development of its mineral wealth simply ask for such co-operation as shall ensure the application of a sufficient amount of capital to command success. With regard to the general history and resources of the Republic, an ample fund of information can be obtained, relating to all previous to 1851, from the admirable little "Bosquejo de la Republica de Costa Rica," by Filipe Molina; whilst for the last fifteen or sixteen years the commercial statistics supply all that can be wished by the most cautious.

The Republic of Costa Rica occupies that portion of Central America which lies between Nicaragua and Panama, and has the Atlantic Ocean on one side, and the Pacific on the other. It was erected into a free and sovereign republic by virtue of a fundamental law of its Congress, promulgated Aug. 31, 1848, and it has since enjoyed peace and prosperity, its Governor having concluded treaties of friendship and commerce with the various foreign countries; and the Republic was the first of the Central American States to conclude a treaty of peace and friendship with her Catholic Majesty of Spain—the mother country of the Republic. Hitherto the agricultural industry has formed the principal resource of the country, although even at the establishment of the Republic there were several gold mines in actual operation. The great coffee plantations at San José, at Heredia, and at other places in Cartago, have ever been a considerable source of wealth. The pearl fisheries of the Gulf of Nicoya, as well as those of Papagayo, have also received consideration, and the various natural resources have been so far availed of that a profitable business has been carried on with Peru, Chili, and California. As to the facilities for shipments to or from Costa Rica, they are enormous; and as the Pacific could be reached from almost any point upon the Atlantic coast, by a journey of 150 miles, the difficulties of internal transit would have been unimportant, even had the means of communication not been so carefully attended to as they have been. On the Atlantic side there is the beautiful harbour of San Juan de Nicaragua, or Greytown, at the northern extremity of the coast, and the magnificent bay of Boca Toro at the southern extremity; whilst on the Pacific there are shipping conveniences not only for carrying on the trade of a small but rich Republic, but of the entire Continent. Amongst the secure and spacious harbours which Costa Rica possesses on the Pacific are the Gulfo Dulce, Puerto Inglés, Las Mantas, Caldera, Puntas Arenas, La Culebra, Santa Elena, and Las Salinas, that of Puntas Arenas being, perhaps, the most important. Indeed, mercantile operations are carried on with the greatest freedom; there is no restriction or formality of any kind, except for spirits and distilled liquors, tobacco, and gunpowder, which are required to be deposited in the public bonded warehouses, and cannot be imported nor exported without special license.

The commercial progress of the republic during the past fifteen years must form the subject of a future article, but in order to show that its internal affairs are in such a position as to encourage and protect industry, it may be mentioned that the executive power is in the hands of a responsible president, who is elected for six years by the people, and cannot be elected twice in succession, and that there are neither slaves nor privileged classes. The dominant religion is the Roman Catholic, but liberty of worship, both public and private, has been solemnly recognised by the constitution, and consecrated by the treaties with Great Britain, the United States, France, the Hanse Towns, &c., and for some years past a protestant congregation has existed without interruption, and has continued to thrive. The facilities for naturalisation are very great. Every imigrant possessing the means honourably to subsist by his trade, or by the proceeds of his capital, can acquire the right of citizenship of the republic from the moment he declares his willingness to become a citizen, and he is forthwith given all the civil and political rights which are possessed by those born in and belonging to the country; whilst those who do not desire to become naturalised are especially protected, being exempted from all personal service, as well as from all extraordinary contributions. These latter can acquire and dispose of at their pleasure all classes of property, and their heirs, when they have any, enjoy the succession, secured by the laws, whether the possessor makes a will or dies intestate. Every encouragement is offered for colonisation, so that in the event of British capital being applied to the development of the Costa Rican mines there would be no difficulty in obtaining an abundance of labour, even from our own mining districts—if European labour were preferred—as industry and care alone are required to enable every man to dwell upon his own property, and to live in happiness and comfort.

MINING, METALS, AND MINERALS—PATENT MATTERS.

By M. Henry, Patent Agent and Adviser, M. Soc. Arts, Assoc. Soc. Eng.

Mr. Gresham Hull's specification relating to safety-fuzes has been recently printed. It is a communication from Mr. Whitehorn, of Melbourne, Victoria. The patent includes an improved manufacture of fuzes, and also certain means or apparatus used in the manufacture of these articles. The patentee proposes to construct a central core, consisting of a number of threads, steeped in or passed through a solution of saltpetre, and twisted together in such manner as to leave a space for receiving the gunpowder or explosive agent. The surface of this core is coated with pitch, and then covered with paper, felt, or other suitable material, but the material preferred is the stiff substance called tipboard by bookbinders. This is previously cut into strips, each of the width of one-half of the circumference of the coated core, so that when put together round it, with their longitudinal edges brought opposite each other, they enclose it, as in a tube, with lateral or longitudinal slits at such edges. The patentee then proceeds to cement, and next he laps or winds round it strips of woven fabric, instead of using tape, as usual. A coating of pitch or tar is then given, and then the core receives a covering of plaster of Paris. The machine used in the manufacture consists of a powder canister, fitted on a revolving horizontal disc, and having a nozzle at bottom, with lateral slits or openings, through which pass the threads to be twisted; these are delivered from reels on the revolving disc. A tube at the bottom of the nozzle receives the threads as fast as twisted by the revolution of the disc and its bobbins, and the threads take up the gunpowder supplied by the disc. The core, as fast as formed, is drawn through the tube by grooved drawing rollers. The core thus formed is wound on a reel, which, when full, is conveyed to a machine, in which it is coated, and receives its paper covering or case. This machine consists of two standards, carrying at the upper ends the reel charged with the core; and two other reels, situated one on each side of the uprights, carry the two narrow strips of paper, for enclosing or covering the core. The core itself, as well as the strips of covering material, are brought into and converge in a bath or vessel of melted pitch, and pass together through an aperture in the bottom thereof, so that the core and covering material are thus coated with pitch, and united together at the same time.

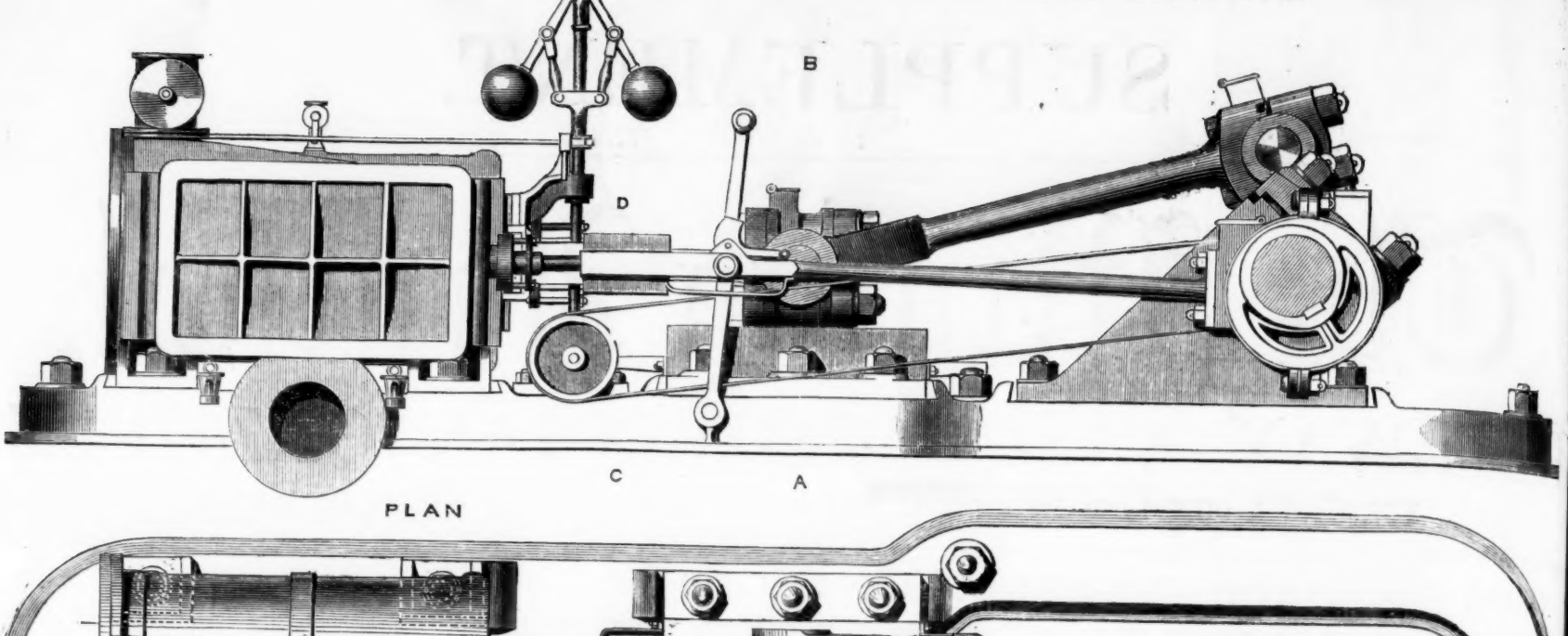
Mr. McBeath, of Blackburn, Linlithgow, has patented some improvements in distilling shale, coal, and other bituminous matters, for the purpose of extracting the gases, spirits, and crude oils, containing paraffine and other valuable substances, from the same by the heat of their own combustion with the air, in open-ended vessels or retorts, allowing or directing the currents of rich inflammable and oily heated gases, or products of combustion, to pass in, at, or up from the open end of the vessel or retort where the combustion is effected, directly up, through, and amongst the bituminous materials. A jet or stream of steam may be applied at or near the neck of the conduit which conveys the distilled gases from the retorts to their condensers, whether the improved retorts be used, or whether other retorts be employed. Messrs. Petin, Gaudet, and Co. have communicated an invention for rolling metals, in which rolls running on horizontal axes are combined with lateral adjustable rolls running loose on vertical axes, so that top, bottom, and sides of the bar may be rolled simultaneously; screw spindles may be used to regulate or adjust the rolls. Mr. Robinson, of Widnes, and Mr. Pierce, of Warrington, have applied for a patent for apparatus used in the manufacture of zinc; and Mr. Doering, of Westminster, has applied for a patent for "engines for boring rock, cutting coal, and boring, cutting, or working in other material, and in stands or frames for such engines, the improvements in engines being partly applicable to other purposes."

London General Omnibus Company.—The traffic receipts for the week ending June 16 was 13,340*l.* 17*s.*

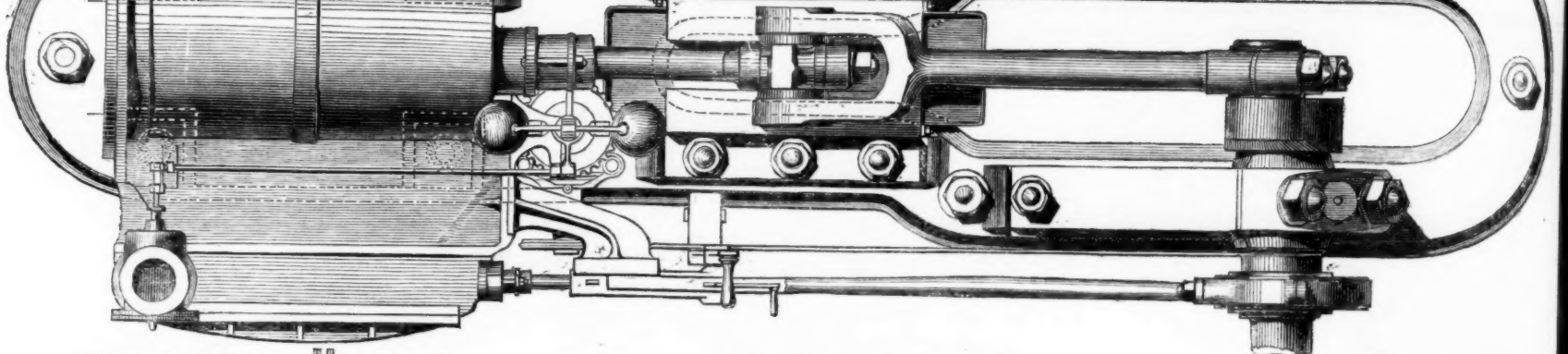
QUICK-SPEED HIGH-PRESSURE EXPANSIVE ENGINE,

BY N. P. BURGH, ENGINEER.

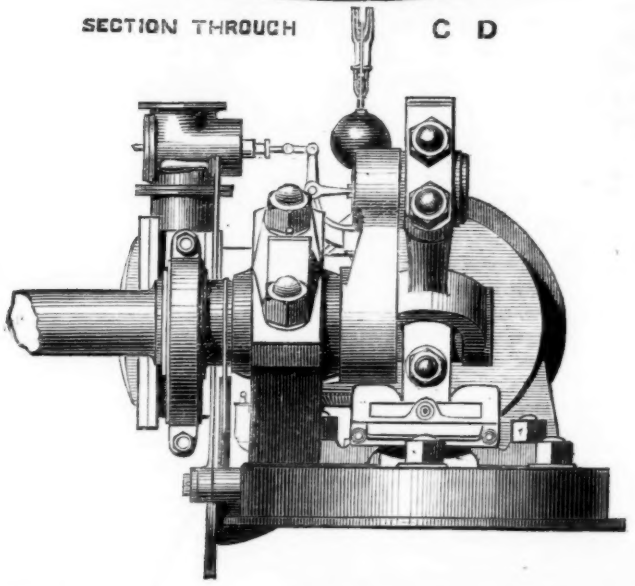
SIDE ELEVATION.



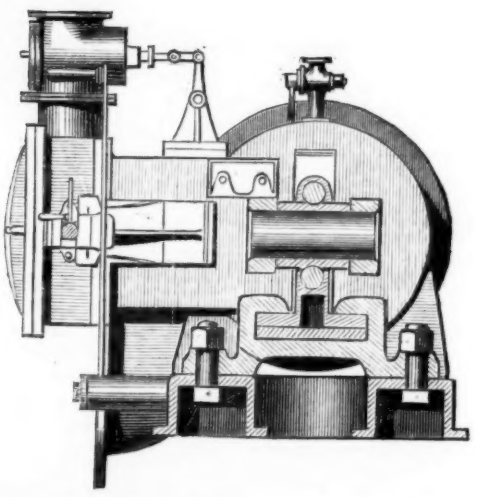
PLAN



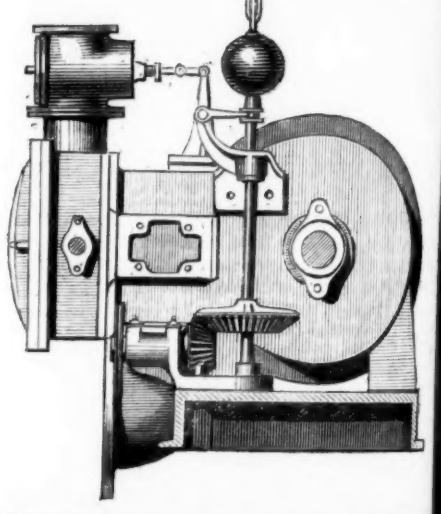
SECTION THROUGH C D



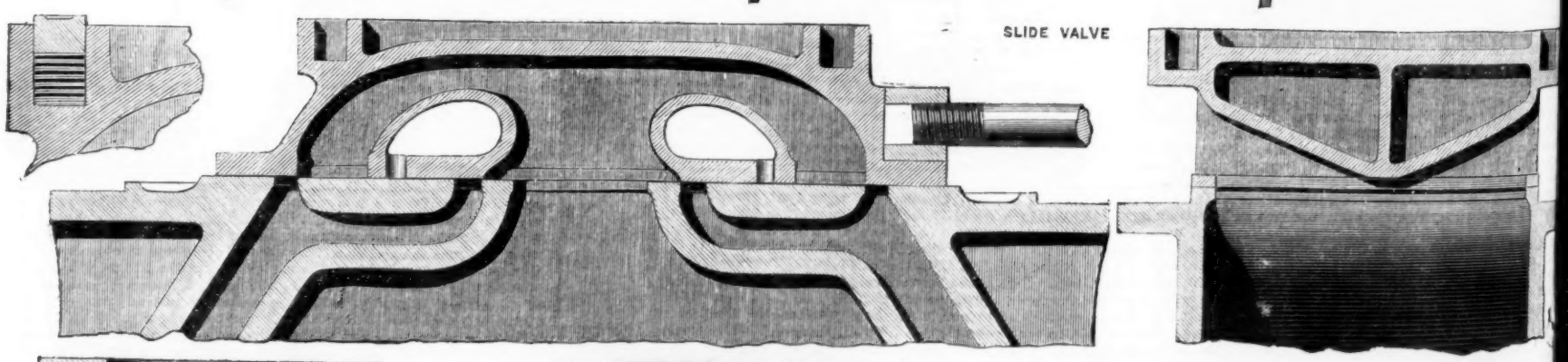
SECTION THROUGH A B



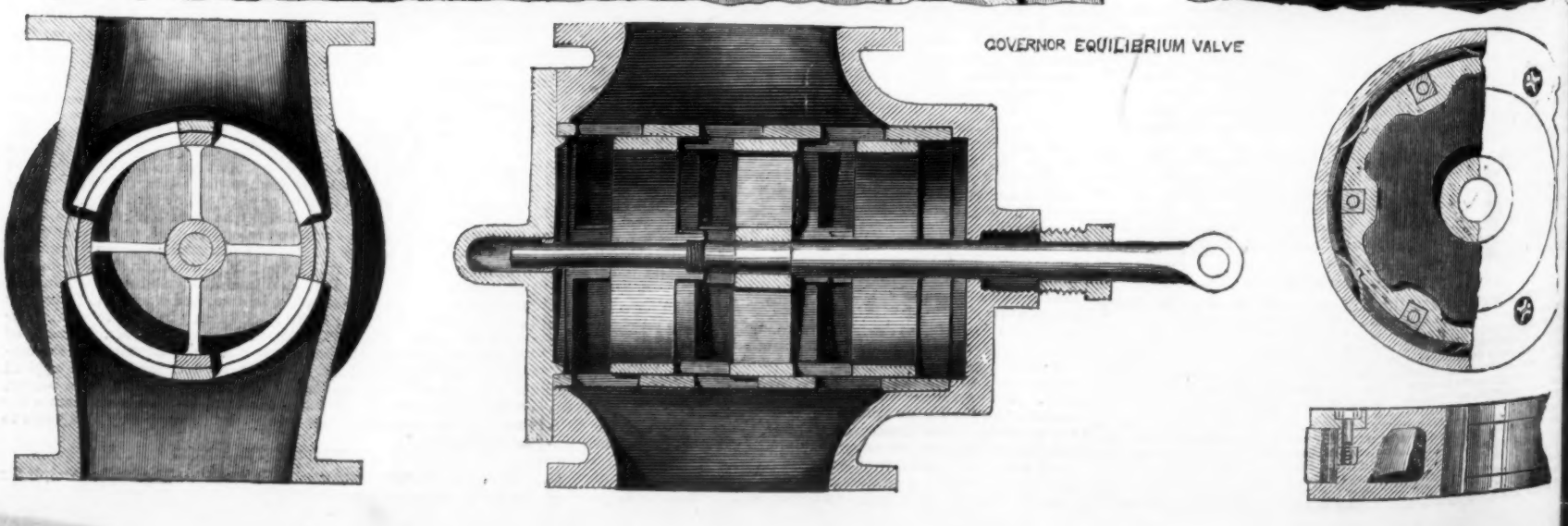
END ELEVATION

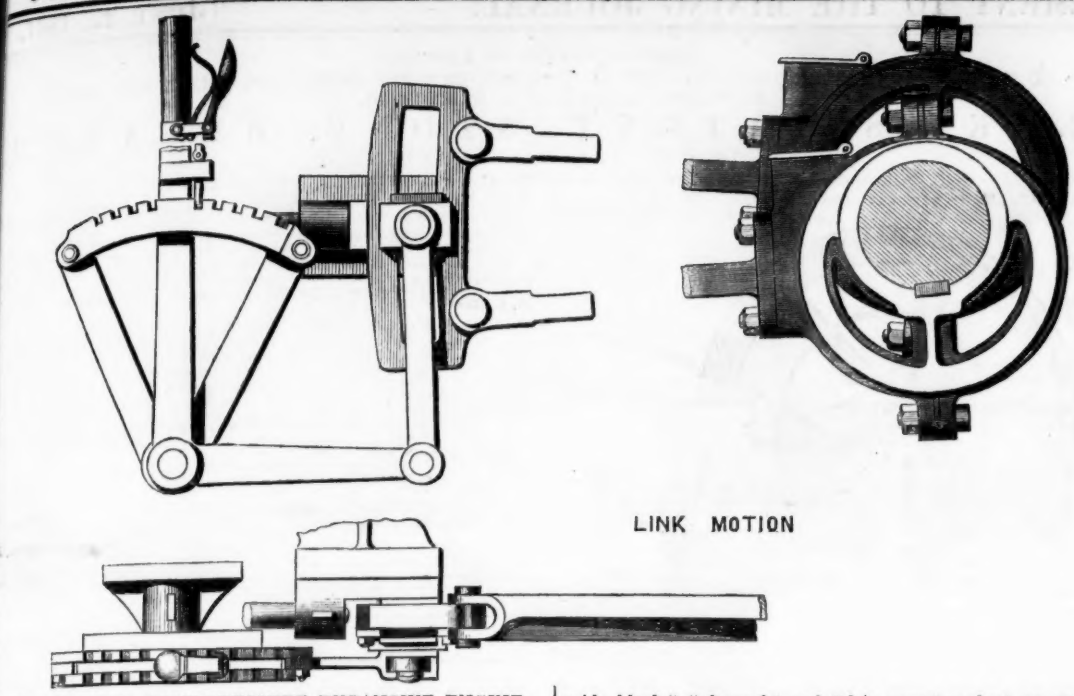


SLIDE VALVE



GOVERNOR EQUILIBRIUM VALVE





LINK MOTION

QUICK-SPEED HIGH-PRESSURE EXPANSIVE ENGINE.

BY N. P. BURGH, ENGINEER.

It is, of course, current amongst those who are acquainted with natural laws that "momentum" is power, and if it be requisite to prove this an example of domestic occurrence is sufficient; for instance, an egg falling from the cup on to the table is bruised only, but if the fall is extended to the floor the egg is smashed, although the *weight* and *strength* of the egg is unalterable. Next, roll a ball down a hill; the speed of the ball at first appears slow, but when "momentum" is disturbing "inertia," and reducing the "friction," the velocity increases proportionately. Another illustration is shown by attaching a string to a weight, and by whirling the latter around at a known radius and velocity a proportionate force is exerted, termed "centrifugal force," which is the main effect of the rim of the fly-wheel of a steam-engine. Now, the observance of these laws in applied mechanics will always produce the best result, or the greatest development of the force or power exerted, minus the power absorbed by friction.

PRINCIPLES—FUEL AND EVAPORATION.—Attention next must be directed to the "power" in a certain quantity of fuel or coal, and the amount of coal that *can* be consumed in a given time. In deducing these matters it is usual to consider—first, the "area of the grate in feet;" second, the "rate of combustion;" and, third, the "evaporative property of the fuel" employed. Commencing, then, with the first proposition, the general practice is to allow three-fourths of a square foot of grate surface per nominal horse-power. Secondly, with ordinary coal and the common single-flued boiler—the flame passing through the tube, splitting at the back end, traversing at the sides, and finally progressing under the shell—11 to 14 lbs. of coal is consumed per hour per square foot of grate surface. Next, then, the third proposition requires demonstration, the principle of which is that a certain amount of heat is in a relative bulk of coal, and the absorption or extraction of that heat is the vital effect. In connection with this fact are three considerations, each being separate in action, but combined in result. First, the "action of the flame," which is the tendency of the heated vapour to penetrate or leave the surface exposed; second, the thickness and conductive property of the surface in question; third, the volume of the water proportionate to the grate surface. This latter clause recognises the fact that *no more heat can be absorbed by the water than is generated on the area of the grate surface*. The *extraction* of the heat is comparatively a simple matter where perfect combustion is attainable, but as that function is not generally accomplished a relative loss results. The *absorption* of the heat generated being the main question, the amount extracted may be passed over, and for the present purpose it will be sufficient to state that *two-thirds* of the heat produced is absorbed by the water in practice, and the remainder, or *one-third*, is *lost* by radiation and direct escape into the atmosphere. Now, as to the "amount of water evaporated proportionate to the amount of fuel consumed," the average ratio, in the present day, is 8 to 10 lbs. of water to 1 lb. of fuel or coal consumed by ignition.

The cubical capacity of 1 lb. of water equals 27·648 cubic inches, and the amount of steam that can be generated from that quantity depends on the pressure attained.

The following table of the relative quantities is the result of practical experience:—

Pressure of steam per sq. in. above the atmosphere.	Cubic inches of water requisite to form 1 cubic foot of steam.
20	2·3
25	2·6
30	3·0
40	3·5
50	4·0
60	4·6
70	5·1
80	5·65
100	6·5

Now, from this table, and the preceding remarks, the amount of steam generated per foot of grate surface is obviously due to the known ratio of the consumption of the fuel and the heat extracted, or, rather, absorbed. Having thus far briefly alluded to the "principles" of "raising the steam," attention is next directed to the "principles" of its use.

PRINCIPLES—EXPANSION OF STEAM.—As far back as the days of Watt, the inventor of the steam-engine, the advantage of using steam *expansively* was recognised, and in the present day it is becoming universal. The gain attained is, that by increasing the pressure a smaller quantity of steam can be used at each stroke of the piston, and the steam being permitted to "expand" in the cylinder a certain power is effected without further supply from the boiler for each stroke. Thus, for example, presume the steam to be cut off at one-third of the stroke, and expansion continued until two-thirds of the progress of the piston's stroke, a *saving of one-third* of the bulk of the steam is attained, or that if the steam were admitted to two-thirds of the stroke of the piston, and then cut off. This is rendered more obvious on remembering that the greater the distance the piston has travelled before the supply of the steam is intercepted, the greater the capacity for the reception of the steam; and, therefore, the more water evaporation, or formation of the steam requisite in the boiler. The reduction of the pressure of the steam by expansion is in direct proportion to the increase of the space occupied. For example, steam, at 60 lbs. per square inch, occupying 10 cubic feet, if expanded into a space equal to 20 ft., will be reduced to 30 lbs. on the square inch. This law is theoretically correct, but in practice a loss of temperature results by expansion, even with steam-jacketed and well lagged cylinders. Before commencing with the illustrations herein given, it may be added, in passing, that the preceding remarks are introduced as an exposition of the "principles" on which the engine under notice has been founded.

DESCRIPTION OF THE GENERAL ARRANAGEMENT.—The "side elevation" depicts the front of the "valve casing," end view of the "governing valve," elevation of the "governor," side view and position of the "eccentric;" and "rod," also the "guide bracket" and "starting handle;" beyond these latter details are seen the "piston-rod guide block," "channel" and "drip pans," and at an angle the "connecting rod," below the crank end of which is the main shaft "plummer block." The "main frame" or "foundation plate," supporting the details, is in one casting, "fitting strips" and "keying ribs" being formed for the relative purposes. Both the cylinder and the main plummer block are secured by bolts and nuts, and adjusted by keys, by which connection a practical cause is recognised. The "motion pulley" for the governor is also seen in this view, and the "band" which transmits the motion from the main shaft. Following the arrangement of the views consecutively, the "plan" comes next under notice; in this view it will be noticed that the entire arrangement is pourtrayed. Commencing, then, at the cylinder end, it will be seen that the "governor valve" is at the back end of the valve casing, and that the variation of the speed of the governor is transmitted by a weigh-shaft and levers, forming a common bell-crank action. The position of the governor can be readily understood, also the mode of motion, without any description. The piston-rod, guide-block, channel, and connecting rod form a continuous line, with the exception of the inner end of the connecting-rod, which is "forked," to clasp the guide-block pin's bearing. The "crank" is the usual wrought-iron type, shrunk on the shaft, and keyed laterally. The plummer-block is more obviously understood from the "elevation" than from the present view.

The form of the "foundation frame" is depicted, also the arrangement of the securing or "holding down bolts." The position of the latter are computed from the *strains* imposed, by the alternate sliding motion of the piston-rod and vibratory action of the crank. The "eccentric, rod, and guide bracket" next engage attention. The main effect, in this case sought after and attained, is that the motion of the "eccentric" shall be *directly* transmitted to the "valve-rod," without any intervening action. The principle of this is apparent, on remembering that *all lines of strains* are *direct*, and that any obstruction to this law does not alter the *natural* action in principle, although the power transmitted may be transposed in adverse directions. The "end elevation" depicts the relative transverse positions of the details, and the total width of the arrangement. The transverse "section through A B" shows the guide block and channel in section, also the forked end of the connecting-rod. The guide block is the slipper type, of universal practice with marine engineers, and fast getting into favour for land purposes. The lower surface is that which receives the impression of the strain from the connecting-rod, according to the direction of the movement of the crank. This will be readily understood on alluding to the "side elevation." Presume the guide block to be moving *towards* the crank-shaft, the direction of the crank-pin will be *from* the cylinder. Now, the crank-pin has no tendency to move in any direction, and, therefore, may be considered as a fixed point until the inertia is overcome by the connecting-rod. The pressure of the steam propels the piston, and the rod being connected to the block, the latter affects the connecting-rod, to which the crank-pin is attached. The force from the piston is, therefore, met by the inertia of the crank-pin, and until the inertia is overcome the resistance is equal to the pressure. The connection of the guide block and the connecting-rod being a joint, it is obvious that if the lower surface of the channel were removed, the piston-rod would bend from the stuffing-box, the strain from the connecting-rod being downward, according to the motion of the crank. Presume the crank to be descending from the horizontal line, and the piston returning from the front of the cylinder. The strain *on* the connecting-rod is reversed, the "push" being turned into a "pull," but the strain *from* the crank-pin, on the face of the guide block, is still on the lower surface. This, then, is the object of the guide block under notice, that inasmuch as the friction imposed is on the lower surface of the guide channel, the upper surface can be reduced to a minimum, and even a clearance can be allowed, which is always so in the engines constructed by Messrs. Maudslay, Sons, and Field. Next, assume the piston to be at the back end of the cylinder, and on its starting the crank *descends*, being a contrary direction to the former. The "push" on the crank-pin will cause the pointed connection of the rod and block before alluded to to *rise*, and thus the strain from the pin is *upwards*, and the friction imposed on the *top* surface of the guide channel. The stroke of the piston may now be presumed to be completed to the front of the cylinder, and on the return action the crank *ascends*, but the "pull" imposes an "upward" friction, still on the guide surface. It is apparent from these facts that the direction of the crank-pin's movement determines the form of guide, and the example under notice is the result of the above considerations, the weight of the guide block, piston-rod, and connecting-rod compensating for the lesser areas of the upper surfaces, when the strain is upwards.

To return to the section, through A B the starting handle and guide bracket for the slide valve rod is shown, also the governing valve casing, the governor being purposely omitted. The lubricator on the top of the cylinder is also shown, and the exhaust steam branch below the valve casing, common to that seen in the side elevation. The remaining elevation, or section through C D, next claims attention; this view is introduced to depict the governor, and its mode of motion. Bevil gearing is adopted, to cause the revolving action, and the sliding motion from the pendulum is transmitted by levers and a weigh shaft. The bracket supporting the governor spindle about the centre of its length supports also the front extremity of the weigh shaft.

DESCRIPTION OF DETAILS—SLIDE-VALVE.—The writer's experience in the form of valve now alluded to, and illustrated at the foot of the views previously described, has led him to adopt it, not only for marine but also for land engines. The longitudinal section shows the width of the steam and exhaust ports, both in the valve and cylinders. The diameter of the cylinder is 1 ft. 5 in., and the length of the stroke of the piston 2 ft.; the width of the exhaust port 4¼, and each of the supply parts ⅞ inch, the opening caused by the slide-valve being ⅞ths of an inch; the outside lap of the slide is 1¾ inch, the cut-off one-fourth of the stroke, and the length of the connecting rod 4 feet. The length of the ports is 10⅜ inches, and the total area of the supply openings for each end of the cylinder equals 7·781 square inches. The transverse section shows the width of the valve, also the recess for the back packing ring, which latter is of gun-metal, and seated on India-rubber, as seen in the detailed section. The ring is shorter than the length of the valve, and wider than its width, by which arrangement the action of the steam on the back of the valve is neutralised, as the area operated on at each end of the flange is the same as that at the sides. The diameter of the valve-rod is 1¼ in., and the throw of the eccentric 2½ in. As the studs and nuts, securing the back cover of the cylinder, are not shown, it may be added, they are each ⅞ths of an inch in diameter, and nine in number. The body of the cylinder is 1½ in. thickness, and the diameter of the securing bolts 1⅜ inch.

GOVERNOR VALVE.—This valve is cylindrical, perforated to admit the flow of the steam when the apertures are opened in the seating. The position of the valve is at half-stroke, or corresponding with the position of the pendulums, as depicted in the "side elevation." The advantage with the valve over the ordinary "throttle" type is that the passage of the steam cannot affect the motion of the valve during the action. For marine purposes the type illustrated has been used with advantage as an "expansion" valve, and, doubtless, ere long, will be universal on land.

STEAM PISTON.—This detail is the ordinary spring kind, with gun-metal nuts recessed in the body, for the face ring studs to pass through. The depth of the piston is 3 inches, and the diameter of the rod 2¾ inches.

LINK MOTION.—This motion is adopted when the engine under notice is required for reversing purposes. The eccentrics are presumed to be loose in the shaft, and the link half raised. The starting handle is vertically situated, also the "lift lever" is in a relative position, or at right angles with the handle. The quadrant is the locomotive type, by which the position of the link is regulated and retained in gear. The plan of the motion shows the bracket supporting the starting handle, also the guide bracket for the slide valve rod.

PARTICULARS OF REMAINING DETAILS.—The lower area of the "piston-rod guide block" is 114 square inches. The diameter of the securing bolts is 2 inches. The diameter of the connecting pin is 4 inches, and the length of the bearing 6 inches; the diameter of the crank pin being 4⅜ inches. and the length of the bearing 5 inches, while the diameter of the securing bolts of the connecting rod is 2 inches. Alluding next to the crank shaft, the bearing is 6 inches in diameter, and the length 9 inches.

The "feed pump," not shown, is 4 inches diameter of plunger, with a stroke of 5 inches for the same, the motion being imparted by an eccentric. The fly-wheel, also omitted, is 6 feet in diameter, this dimension being in accordance with the speed of motion. The weight of the rim being 24 cwts., and of suitable construction.

POWER, NOMINAL AND ACTUAL.—The pressure of the steam will be 65 lbs. on the square inch in the boiler, and the loss by radiation and friction during the traverse from the boiler is estimated at about 3 lbs. on the square inch. The back pressure in the cylinder is about 2 lbs. on the square inch, while in some cases it will be less. As the grade of expansion is one-fourth, or, when the piston has travelled 6 inches from the front or back end of the cylinder, the steam is cut off, and the exhaustion commences when the piston has travelled 18, or 12 inches from the point of cut-off; the mean pressure in the cylinder is known by the following formulæ:—let

x = mean pressure of the steam in the cylinder in lbs. per sq. in.
a = total or full pressure in the boiler.
b = loss by radiation.
c = back pressure.
d = ratio of expansion. [pansion.
e = reduction of pressure due to loss of temperature during ex-
$x = a - b + c \div d - e$, which results in 28 to 30 for the mean pressure.

Now, the speed of the crank-pin will be about 628·32 lineal feet per minute, being equal to 400 feet of piston speed and 100 revolutions per minute. It is evident by this speed that momentum must greatly accelerate the action of the steam; and the writer has no doubt about attaining the speed mentioned, as he has lately driven an engine with a 15-in. stroke of piston above 400 strokes per minute, with only 20 lbs. of mean pressure in the cylinder, and considerable back pressure; and yet the engine developed an excellent result of duty proportionate to its size. The advantage of quick speeds is also now acknowledged by the Admiralty at last, who run the engines of their steam launches 340 revolutions per minute with ease. Next, the "nominal horse-power" demands attention, which, although conventional, is worthy of remark. The writer's practice is to allow 7 to 9 square inches for the area of the cylinder per nominal horse-power with ordinary engines, but with expansive-engines 11 to 12 square inches is introduced, which, in the present case, results in 20-horse power nominal. The actual power is a matter of simple formula, thus let—

x=indicated horse-power.
a=mean force on piston in pounds.
b=speed of piston in lineal feet per minute.
c=constant 33,000.

Thus $x = a \times b \div c$, which produces 154 *actual horse-power*, being 7·7 to 1 of the nominal horse-power. Now, this ratio, although appearing high, is not alone as an example, as latterly higher ratios have been attained with condensing engines under adverse circumstances.

The writer, in conclusion, may add that no attempt is here made to condemn any example, or even make the least comparison advertently, but merely an exposition of the *truth of natural laws* and their application for high-pressure engines on land.

INTERESTING EXPLORATION IN SOUTH STAFFORDSHIRE.

WASSEL GROVE TRIAL SINKING.

On Monday last this important and interesting sinking and exploring was visited and inspected by a great number of mine agents. It being the intention of the proprietors to abandon all further search for coal, this was the last opportunity of examining it. By the kind permission of the lessees, invitations were sent to the members of the Incorporated Association of Mine Agents through their honorary secretary (Mr. Henry Johnson), giving them the opportunity of inspecting one of the most interesting explorations ever undertaken in the South Staffordshire coal field, and upwards of 30 mine agents and coal masters descended the trial pit. One portion of the visitors descended at half-past 10, and the remainder at 12 o'clock; and as the exploring headway was driven in to the extent of 500 yards from the pit shaft, it took about an hour and a half to traverse and carefully inspect it. Amongst the number we noticed the following:—Mr. William Hopkins, agent to the lessees (Messrs. Crampton and Co.), Mr. Henry Johnson (honorary secretary to the Mine Agents' Association), Mr. Wm. Madeley (secretary to the Dudley Geological Society), Messrs. Jas. Gauden, Wm. Spruce, Chas. Ketley, J. Blakemore, Benjamin Caswell, Elijah Robinson, Jas. Ritson, Elijah Davies, W. H. Howl, Wm. Deeley, W. B. Collis, John Collis, Richard Palmer, Robert M'Ghie, Jno. Lawley, Jno. Cooksey, J. Cooksey, jun., J. U. Fellowes, H. Farrington, jun., Richard Evans, Wm. Evans, Jas. Lindop, Edwd. Greenway, James Cope (Pensnett), John Hall, John Dawes, jun., J. Hicks, W. Brooks, &c.

Wassel Grove is an estate of about 600 acres, the property of Major Richards, and adjoins the delightful grounds of Hagley Park, the seat of Lord Lyttelton, and is about two miles from the Hagley and Stourbridge station on the West Midland Railway. For many years past the existence of the thick coal under this estate has been the subject of much discussion and speculation by scientific and practical men, and about 15 years ago a trial shaft (the upper portion of the present one) was commenced by Mr. G. H. Bond, but after sinking it about 80 yards and boring 15 yards, it was abandoned on account of the great influx of water. One or two thin seams of coal were at this time passed through, but were not recognisable with any known beds of the other portion of the coal field. About five years ago Mr. George Elliott, an eminent mining engineer and coal proprietor of the North of England, bored on the north-western edge of the estate to a depth of 189 yards 2 feet, and at a depth of 175½ yards, came upon 37 feet thick of alternating but very thin layers of coal and bat, which was set down to be the representative of the thick coal, but was considered very doubtful as to quality. Mr. Elliott, after expending about 1500*l*., in putting down this borehole, declined to proceed with any sinking, whereupon Mr. George Pell took a lease of the estate, and proceeded to deepen the trial-shaft commenced by Mr. Bond, and after a time the lease was transferred to Messrs. Crampton and Co., eminent railway contractors, who have expended about 12,000*l*. in continuing the search, and it is to be greatly regretted without the least hope of finding any "black diamond" worth working at all, or, indeed, any other mineral, either ironstone or fire-clay. The present trial-shaft is sunk to a total depth of 262½ yards; the upper 50 or 60 yards of this shaft goes through the greenish yellow sandstones which appear at Hales Owen, then into white rocks and blue shales, then into variegated marls, then into blue shales, and at 165 yards there is about 25 feet of thin layers of coal, carbonaceous shales, and fire-clays alternating, which are supposed to represent the beds of the thick coal in their attenuated and altered form, and it is in these beds of coal and black shales that the exploring headway has been driven for 500 yards across the middle of the estate towards the productive portion of the coal field. At about 50 yards below these dark beds occur red and purple micaceous sandstones, which are thought may be the representative of the old red sandstone, below which is a singular pebble bed 15 feet thick, unlike anything in the true coal measures of South Stafford-

shire (containing a large trunk of silicified wood), and at a depth of 247 yards occur 5½ yards of greyish micaceous sandstone beds, alternating with thin bands of impure limestone, containing *Lingula cornea* in great abundance, remains of *Pterygotus* (including claw or pincers found by Mr. Charles Ketley), spines of *Ceratiocaris*.* These remains clearly point to the latter beds being a portion of the Upper Ludlow (Silurian) Rocks, probably the Downton beds. None of these fossils have ever been found in the South Staffordshire coal field, but are to be found in great abundance in the Upper Ludlow formation, near Ludlow. The Lower Ludlow or Amestry limestone crops out at the Hayes, about 1¼ mile north-west of Wassel Grove. It has, therefore, become hopeless to proceed with the sinking for coal any further. The headway before referred to has been driven out of the side of the shaft at 165 yards from the surface, and has now reached to a point under the lawn in front of Wassel Grove House, for a total length of 500 yards. It is nearly level, and crosses only one fault—an upthrow north of about 15 ft. at 400 yards from the pit shaft. The headway is about 5 feet high, and trial holes have been sumped up and down at different points along the headway for 20 to 25 ft., only, however, to discover the same unproductive measures as were sunk through in the shaft. The whole thickness of 20 to 25 feet being little else but a mass of indurated mud and fire-clay, with here and there variable beds of coal a few inches in thickness, with no regularity of deposit or parallelism of the beds. It is singular to relate, but very significant of the fact of the worthlessness of the coal, that this extraordinary long length of headway never yielded the least explosive gas. At the extreme back or end of the headway it yielded a little water, which was observed by some of the party present to be rather favourable to a change for the better than for the worse. It is, perhaps, worth recording that the whole length of the headway was ventilated by what is called a "blow-george" and 9-in. air pipes, and at the time 19 visitors were in the headway, the air was pure, and the visitors comfortable.

After the last batch of visitors had ascended the pit, the inspection of the excellent plant erected for the raising of the coal drew their attention, and became the theme of admiration; but the disappointment to, and sympathy for, the enterprising and spirited lessees was re-echoed by all parties present.

It being now 3 P.M., the whole party proceeded to the top of Clent Hills, and it being holiday time, and little or no smoke arising from the Black Country below, one of the grandest prospects that could be imagined lay before them. Looking to the north lay the whole of the Black Country, with its hives of industry, while to the south lay the beautiful landscape afforded by the counties of Worcester, Hereford, and Gloucester. The party returned by the 7·5 train from the Hagley station, all delighted with their visit.

We may add, for the information of those who may be interested in the search for coal at this end of the coal field, that plans and sections of the trial pit and headway were prepared and exhibited on the spot by Mr. Henry Johnson, of Dudley, who will be glad to show them at any time, and through the kindness of Mr. Hopkins, Messrs. Crampton's manager, specimens of the whole of the sinking have been presented to the Dudley and Midland Geological Society, where they will be deposited for inspection, together with the plans, sections, and fossils.

—*Birmingham Daily Gazette*, June 17.

* Mr. Henry Johnson, of Dudley, will be happy to show them to any gentleman who may wish to see them.

THE OAKS COLLIERY.—In last week's Journal we briefly announced the result of the important meeting of mining engineers, which was held at the office attached to the Oaks Colliery for the purpose of considering the propriety of opening the shafts, with a view to the recovery of the bodies. Amongst those present were Mr. Evans, Mr. Dickinson, and Mr. Southern, three of the Government Inspectors of Mines; Mr. Foster and Mr. Potter, Newcastle-on-Tyne; Mr. Woodhouse, Derby; Mr. Hedley, a late Inspector; Mr. Embleton, Methley; Mr. Bidder, London; Mr. Cooper, Masborough; Mr. Nicholson, Middleton; Mr. Jeffcock, Sheffield; Mr. Dymond, Mr. Maddison, Mr. Minto, Mr. Beaumont, and others. After minutely examining all the shafts, and the pipes through which the gas continues to come up in large quantities in the No. 2, the party returned to the office, when all the circumstances relating to the opening of the shafts were gone into. After rather more than three hours deliberation, it was resolved that the No. 1 shaft should be first opened to the drift at the bottom; and that the meeting should be adjourned to the call of the local committee, consisting of Mr. Brown, Mr. Potter, Mr. Embleton, sen., and Mr. Mammatt, and that Mr. Jeffcock Mr. Beaumont, Mr. Mammatt, and Mr. Embleton, jun. be the executive for superintending the work connected with the re-opening of the colliery. It was also agreed that operations should be commenced as soon as possible. A considerable number of the widows were outside the office, and requested to see Mr. Woodhouse. On that gentleman coming down one of them said that, having relatives in the pit, they were very desirous of knowing what decision the engineers had come to as to the recovery of the bodies. Mr. Woodhouse addressed them in very feeling terms, stating that the engineers had agreed to open the pit at once; but it was a work which would probably take much longer time in doing than most of them might suppose. It would be a work in which the progress made would be slow, but as they might rest assured that it would be carried out as quickly as possible they would continue to bear with the same patience they had hitherto done until that period arrived. The poor woman appeared much pleased with the information, and the news soon spread through Hoyle Mill and Barnsley, where a similar feeling prevailed. Several of the colliers who congregated on the bridge leading to the colliery expressed an opinion that the decision come to was satisfactory, remarking that there would be no need to ask for volunteers when the time arrived, as they would all be too glad to have the opportunity of assisting. It was stated that there would be about 200 yards in depth of rubbish to remove from the shaft, which is 7 ft. 6 in. in diameter. In the No 2 shaft the scaffolding will remain, and the pipe, which throws up a good deal of gas, will have the valve opened, for the safety of the men at work in the other one.

The report of Mr. J. Kenyon Blackwell, who attended the inquest at Barnsley, according to the instructions of the Home Secretary, enters at considerable length into the circumstances of the catastrophe. He does not think that a sufficient constant supervision was exercised to prevent the occurrence and continuance in use of damaged lamps during the hours of working. He adds that there were periods when the perfect state of every lamp in use throughout a large part of it was the only safeguard against the destruction of all the men employed. At the same time the condition of the pit, with its 50 miles of open roads, the absence of all secure separation in the ventilation of the various districts, the continuity of all the air channels extending around the external boundary and traversing the interior in every direction, was such that if the volume of gas ignited in any explosion were large the explosion would spread everywhere, and involve all the men working in the pit in one common catastrophe. He considers that the system under which the coal in this pit was being worked was highly dangerous. No drainage of the fire-damp existing in the measures had taken place by any preliminary drivage or partial working; but as soon as the levels entered the maiden coal in this thick fiery seam it was exhausted by working it out with faces 400 or 500 yards in length, over areas of 20 or 30 acres in extent, in close proximity to each other. There was no attempt to isolate the different districts. A large explosion might sweep everywhere throughout the pit. In the Barnsley Main coal, when the depth reached, as at the Oaks Pit, is considerable, the pressure on the fire-damp contained in the strata is such that it must burst violently from time to time into any large excavations formed by working the seam, and the more violently in proportion to the extent of the excavation. The only mode of relieving this coal from this great and dangerous pressure, and of rendering these outbursts less in volume when they occur, is by the extensive drivage of levels and straight work prior to the working of the coal; and after this has been effected, by the partial working of the coal before extensive goaves are formed in it. When, as with this seam, the coal is thick, and when the area to be worked is not very large, it would be better to drive all the levels to the outside boundary, and to commence the working of the coal by bringing it back from that point. In such a seam a partial working on a narrower system in commencing would be safer than that which has latterly been practised at the Oaks, where goaves of 20 or 30 acres in extent have been formed immediately on the first opening into the seam, following up on the deep wall faces of 400 or 500 yards in length. As with the most careful and judicious management it is impossible to prevent all accidents from explosion in deep fiery mines, it is necessary to endeavour to limit their effects in the pits in which they occur. The area of pits is constantly increasing from the increasing depths at which it become necessary, from the exhaustion of the seams near the surface, to work coal. The number of shafts applied to the working of any given area must, therefore, diminish. If, however, the districts in the interior of extensive mines were securely divided, if there were no communication existing in the ventilation of one district or one level course with another, it is probable that an explosion would be limited in its consequences.

ARTIFICIAL FUEL.—Heretofore, in order to cause small coal, or coal dust, to adhere so as to form solid blocks, it has been found necessary to introduce and incorporate with the coal dust pitch, bitumen, tar, or some other adhesive substance. In order to mix these substances together and form the compound into blocks, expensive and cumbrous machinery has been required, and it has also been found necessary to heat and char, or partially burn the blocks. The object of the invention of Mr. J. ROBERTS, of Cranmer-road, Brixton, is to cause the several particles of small coal to adhere together, so as to admit of the mass being moulded into the desired form. To this end he makes the small coal or coal dust into a concrete mass, by the addition of pulverised lime and water. The lime may be added in various proportions, but he finds that from one-tenth to one-twelfth the quantity by measure of lime, well slaked with water, will be amply sufficient to form the coal into a hard concrete, but somewhat porous mass. The materials, when mixed, may be placed in a wooden, earthen, metal, or other moulds, until the concrete becomes firm enough to be turned out to dry, for which purpose it will only be necessary to expose it to the air or wind for a few hours. The blocks will thus, in a day or two (without the application of any artificial heat), become hard enough to admit of moderately rough handling, and will burn with clearness and steadiness in any common grate or fireplace. He finds common lime answer the purpose of making a concrete fuel as well as any of the stronger and more expensive cements, and, therefore, on account of its cheapness, he prefers to use it.

UTILISING SCRAP IRON.—An improved method of utilising Bessemer and other steel and iron scrap has been provisionally specified by Messrs. CLAY and BOWATER, of Liverpool. They heat it in any convenient manner, and whilst it is still warm pour liquid Bessemer steel around it, or after heating it they place it in or amongst liquid Bessemer steel, in either case during the solidification of the mass, and so form a strong casting, be it in the form of an ingot or otherwise. The croppings of Bessemer steel rails and other heavy bars and rods, as well as scrap of Bessemer cast and other steel, and of malleable and other iron, of various shapes, can be thus utilised.

QUICKSILVER.—During the past year the total production of the various quicksilver mines of the world was about 85,534 flasks, of which the old Almaden of Spain and the Idrian mines of Austria supplied 39,625, while the remainder came from California.

NEW GLUE.—A German chemist, M. C. Puscher, has discovered that if "glue or gelatine be mixed with about one-fourth of its own weight of glycerine, it loses its brittleness, and becomes useful for many purposes for which it is otherwise unfit." M. Puscher uses mixtures of this kind for dressing leather, preparing artificial bones, for giving elasticity to porcelain, parchment, or enamelled paper, and for bookbinding.

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